



ATOM CO AND AEROSOLS IN THE CONTEXT OF INTERANNUAL VARIABILITY: A SATELLITE VIEW

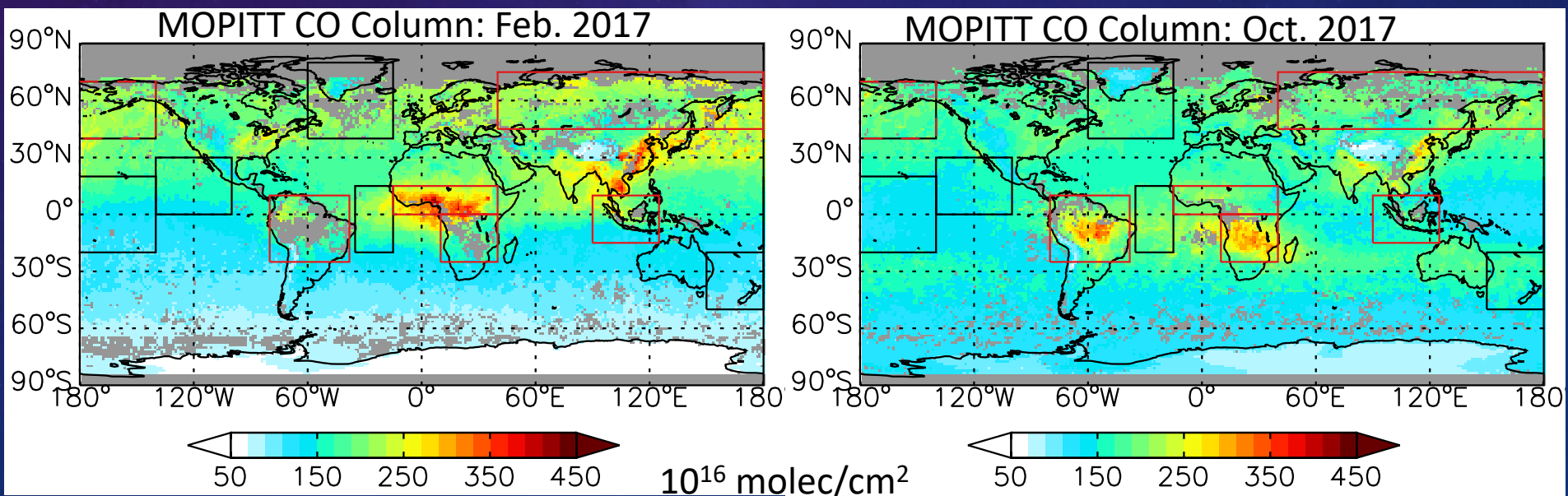
Sarah Strode and Junhua Liu

INTRODUCTION

- CO and aerosols show interannual variability (IAV)
 - Consider temporal representativeness of ATom
- Did ATom occur during “typical” years, or anomalous ones?
- Satellite observations can show how the ATom period compares with previous years
- We will consider the 4 ATom deployments in relationship to IAV

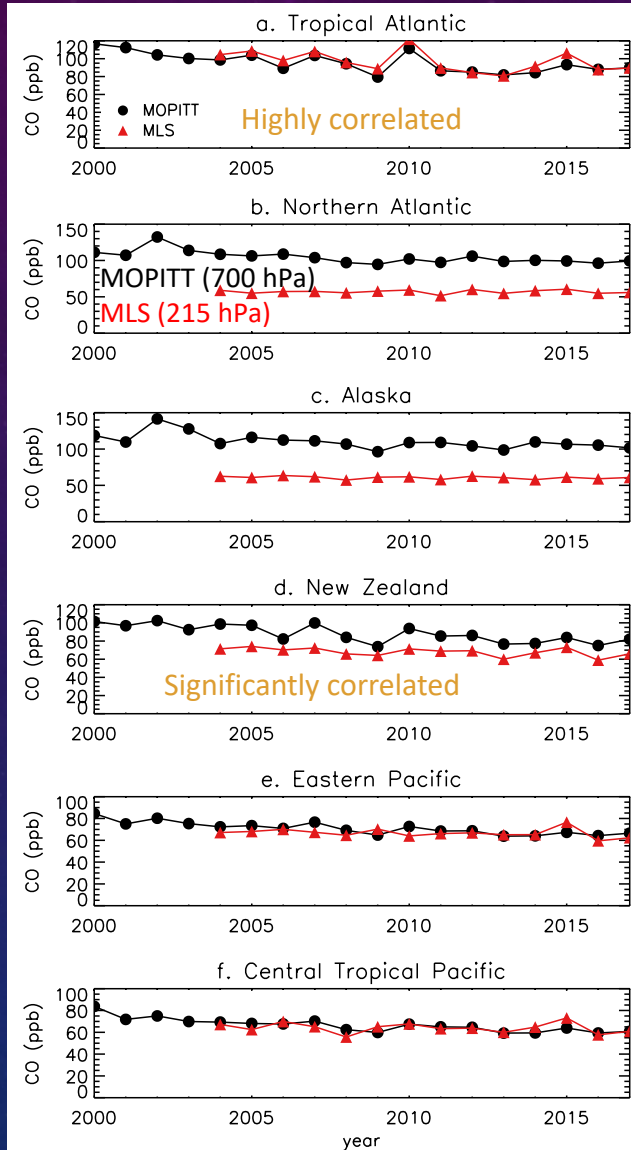
APPROACH

- Satellite data for CO & aerosols:
 - MOPITTv7 TIR column and 700 hPa CO data
 - MLS 215 mb CO
 - MODIS Aqua Aerosol Optical Thickness (AOT), ocean only
- Average satellite data over regions (black boxes) crossed by ATom
- Average GFEDv4 biomass burning CO emissions over relevant burning regions (red boxes)



HOW DOES CO & AEROSOL VARY BY YEAR?

Oct. CO



Tropical
Atlantic

Northern
Atlantic

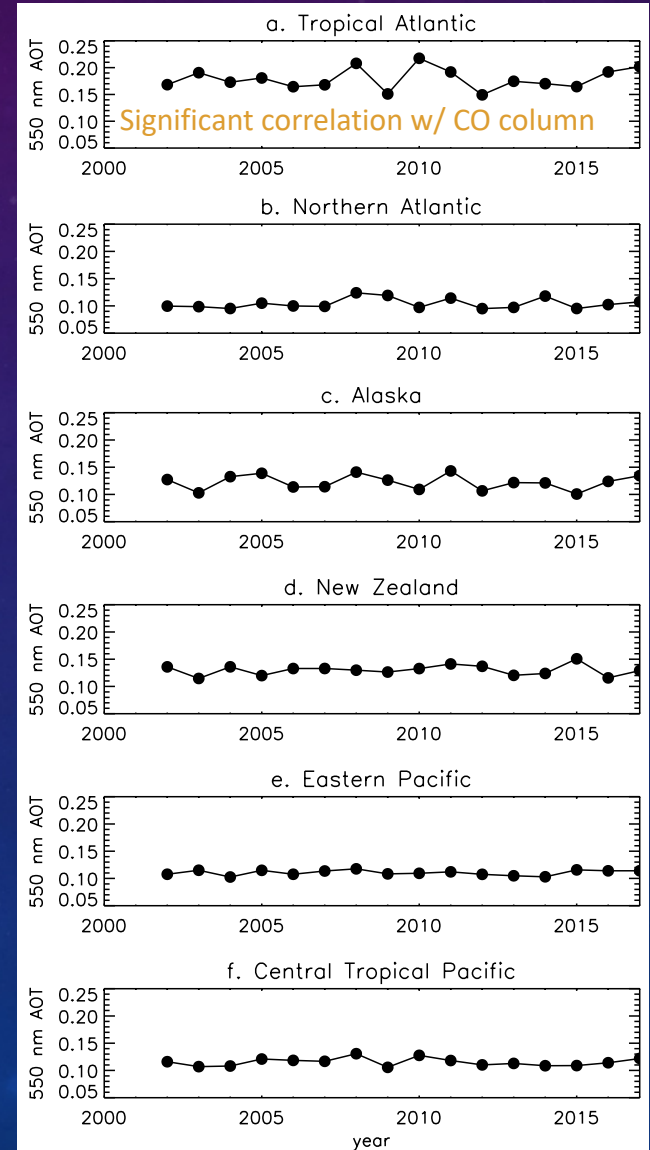
Alaska

New
Zealand

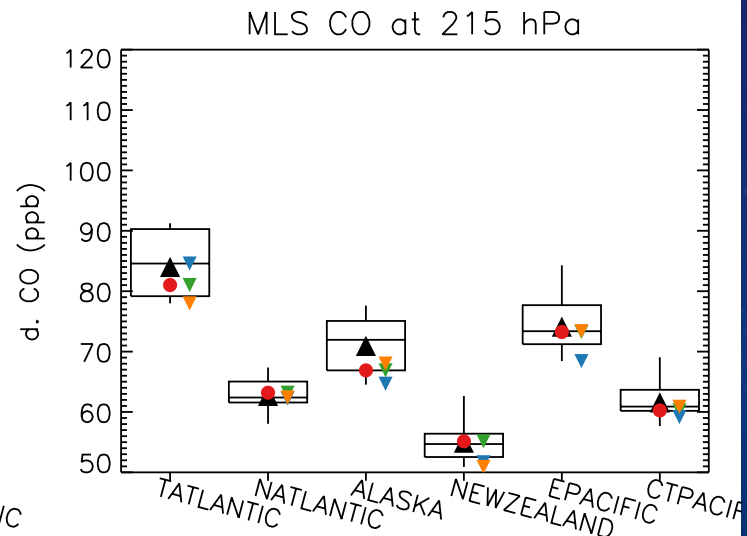
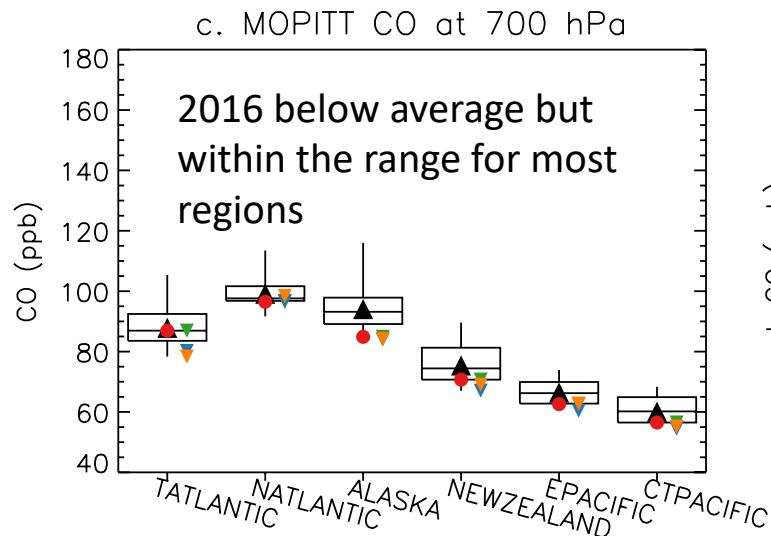
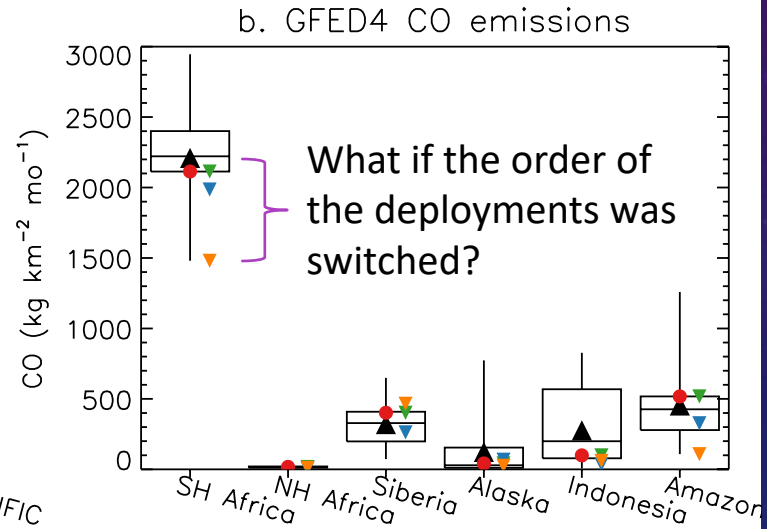
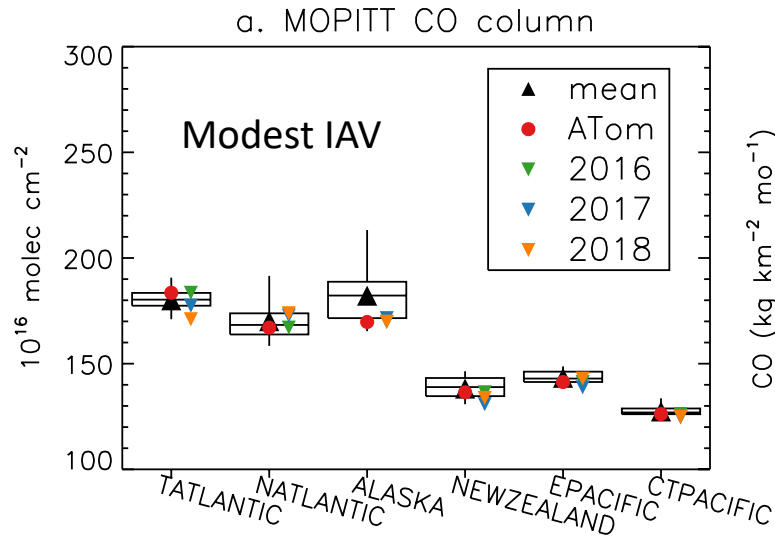
Eastern
Pacific

Central
Tropical
Pacific

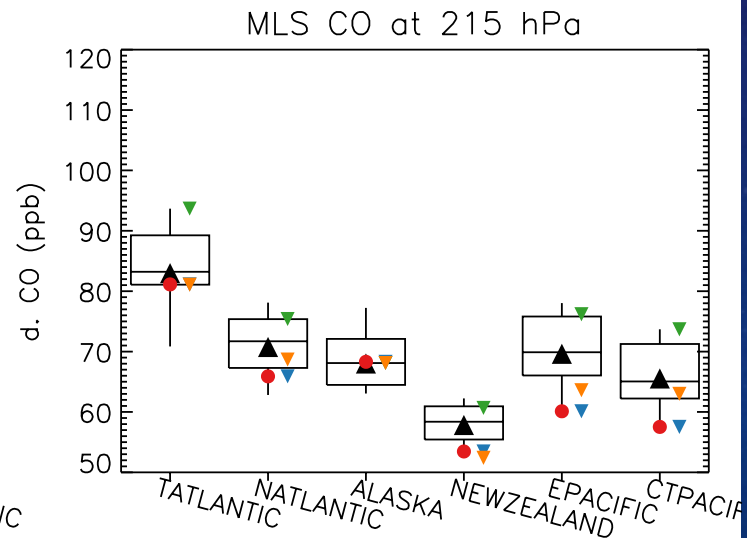
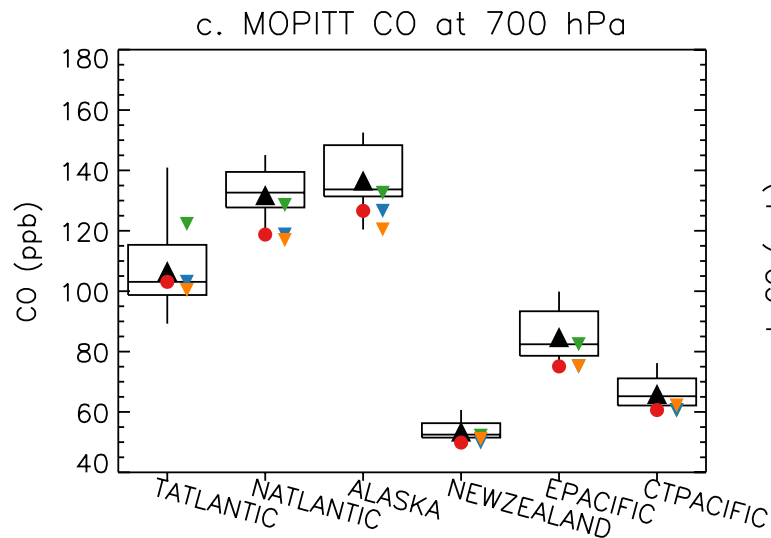
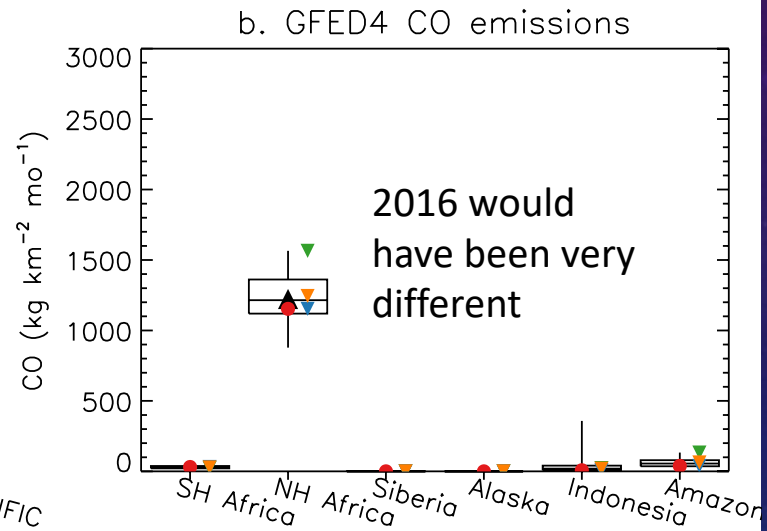
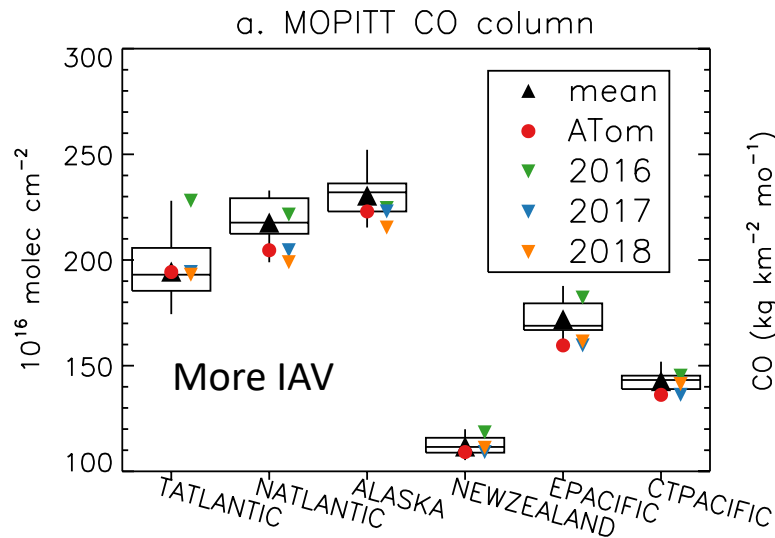
Oct. MODIS AOT



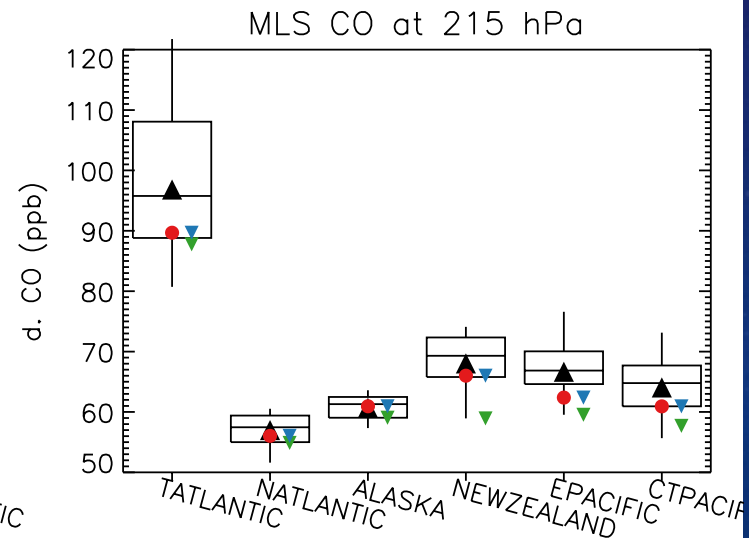
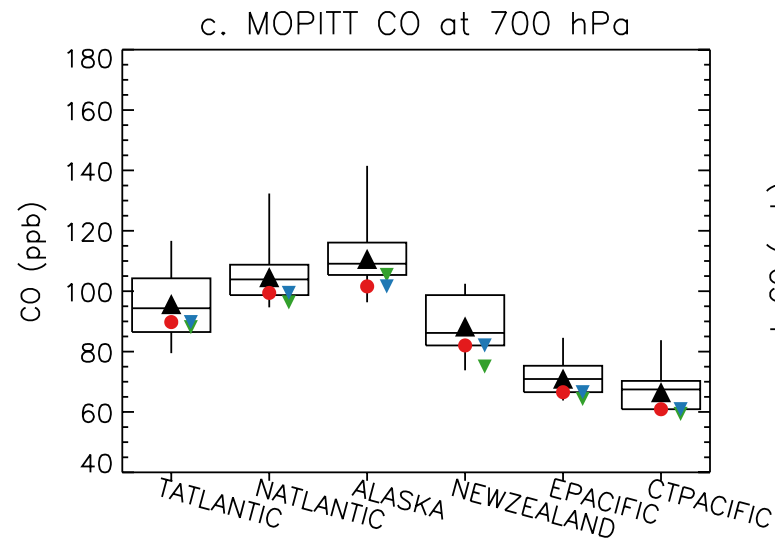
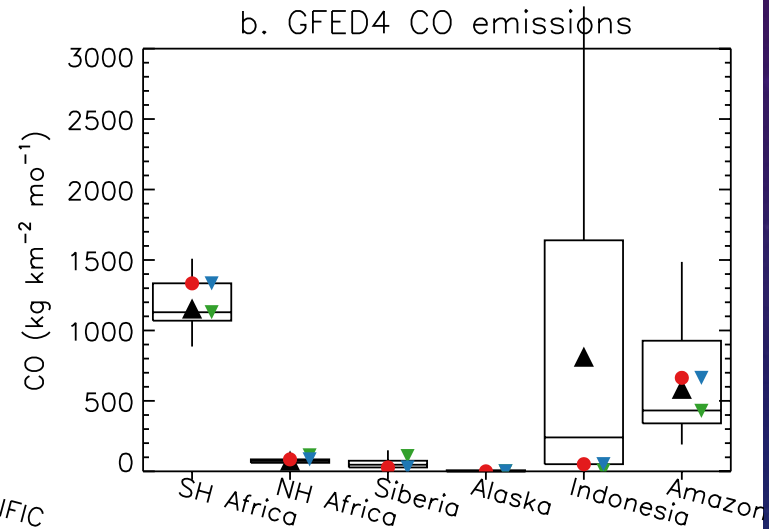
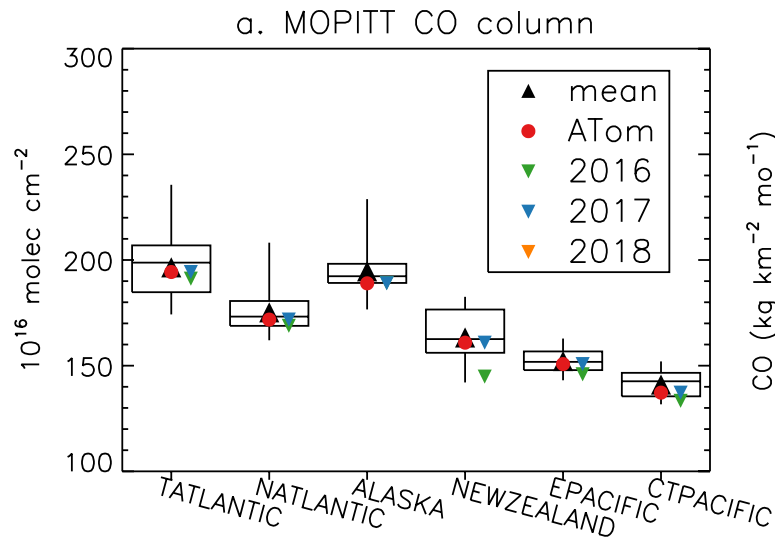
AUG. 2016 VERSUS OTHER AUGUSTS



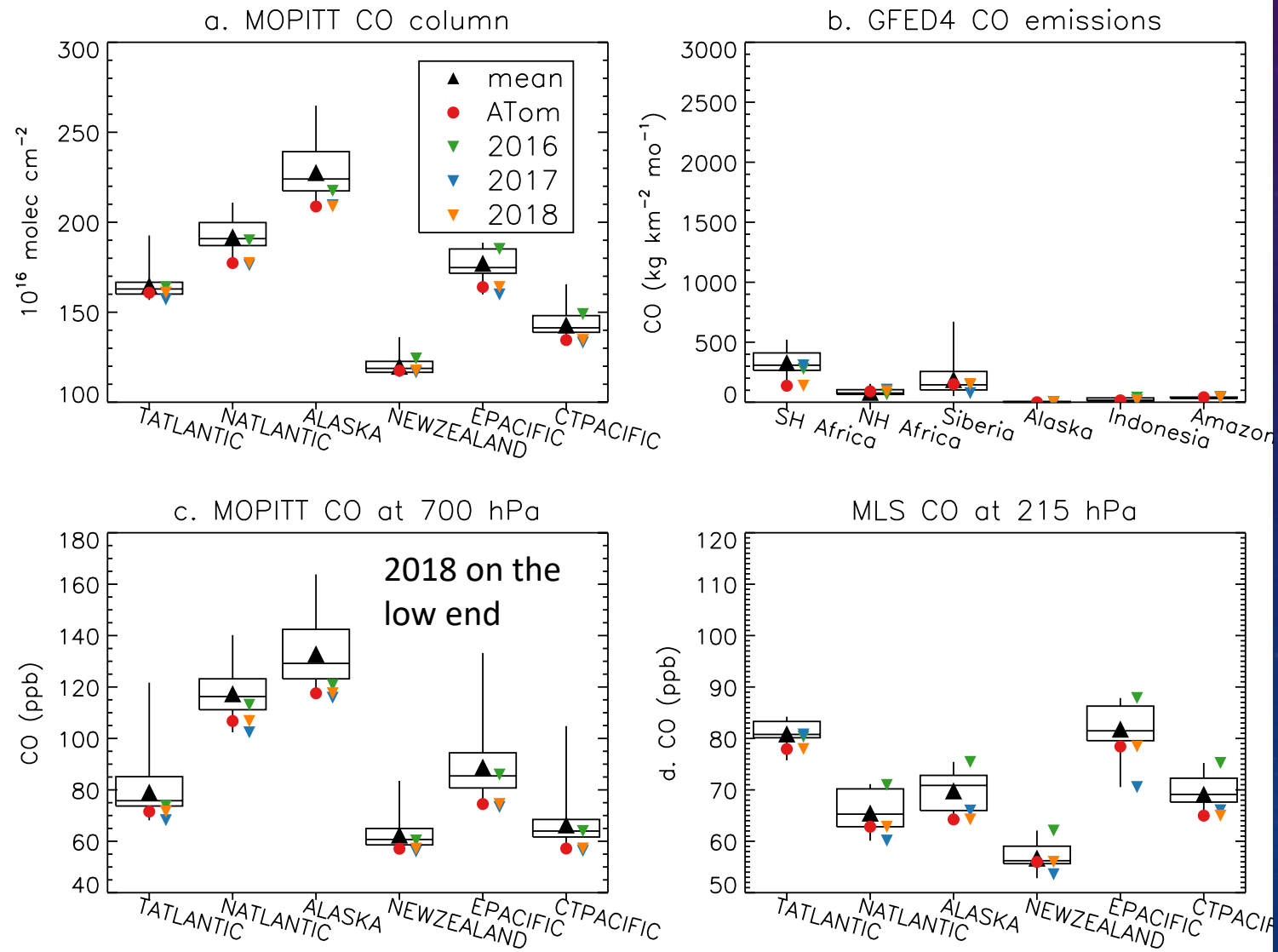
FEB. 2017 VERSUS OTHER FEBRUARYS



OCT. 2017 VERSUS OTHER OCTOBERS

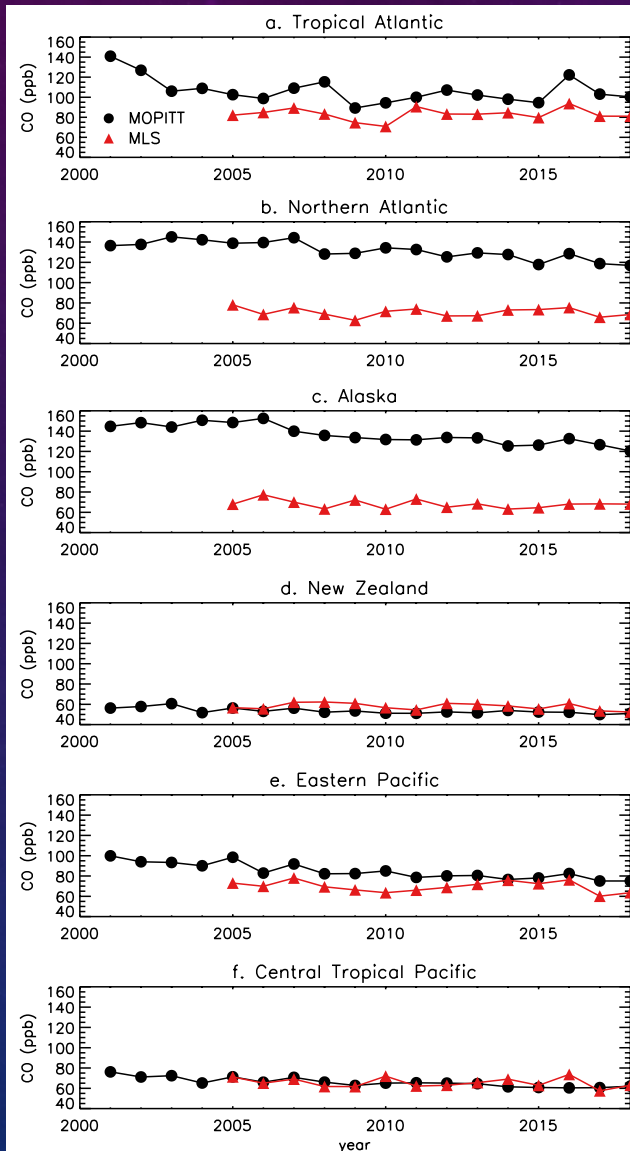


MAY 2018 VERSUS OTHER MAYS



WHY ARE 2016-2018 ON THE LOW SIDE OF THE CO RECORD?

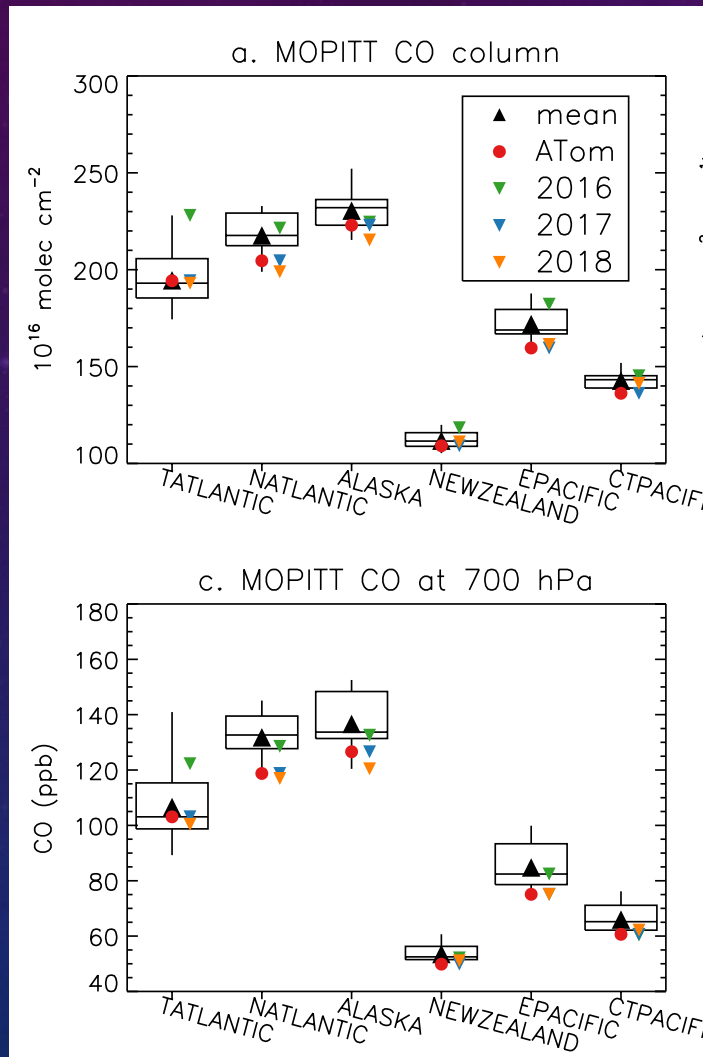
Feb.



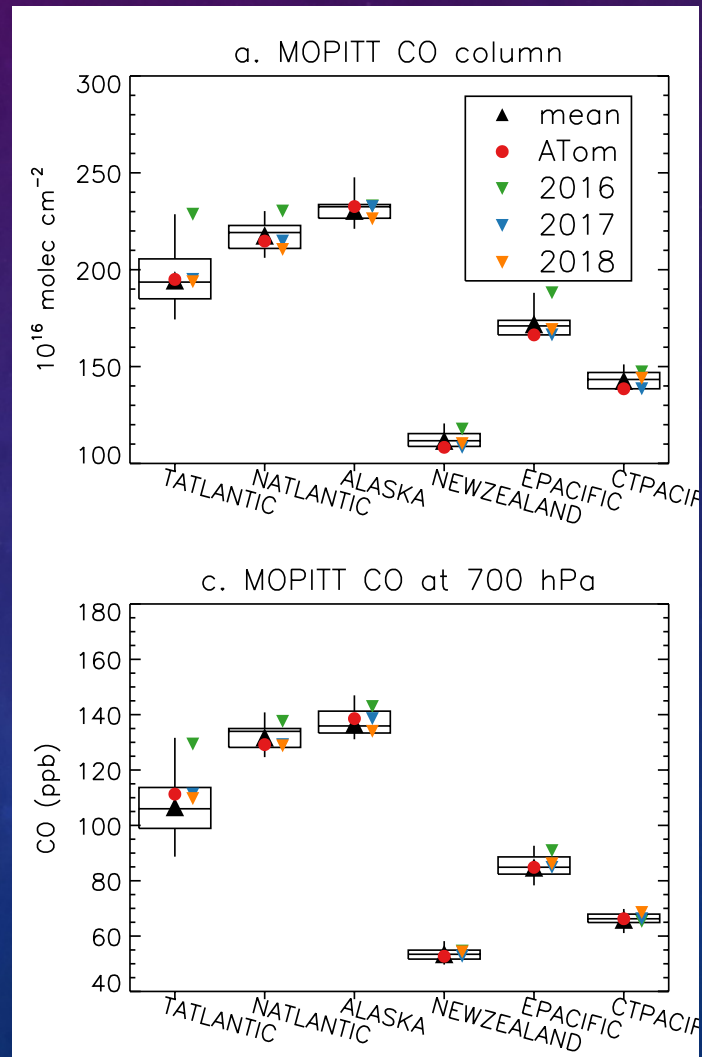
- Is CO getting lower in general?
- MOPITT CO appears to be decreasing over time
- Worden et al. (2013) reported significant negative trends in CO
- Is the decrease real?

LETS REMOVE THE TREND FROM THE VARIABILITY

Feb., original timeseries



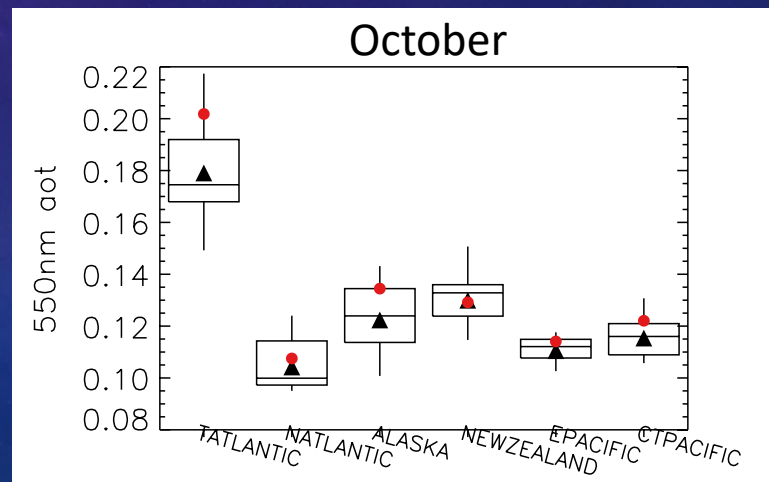
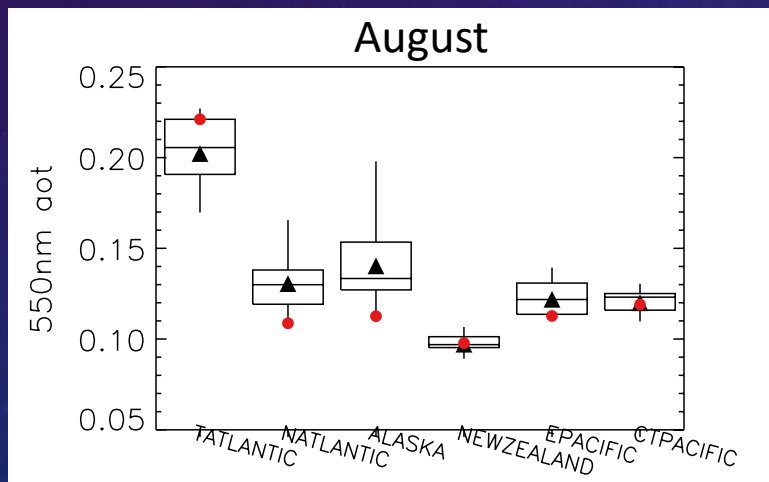
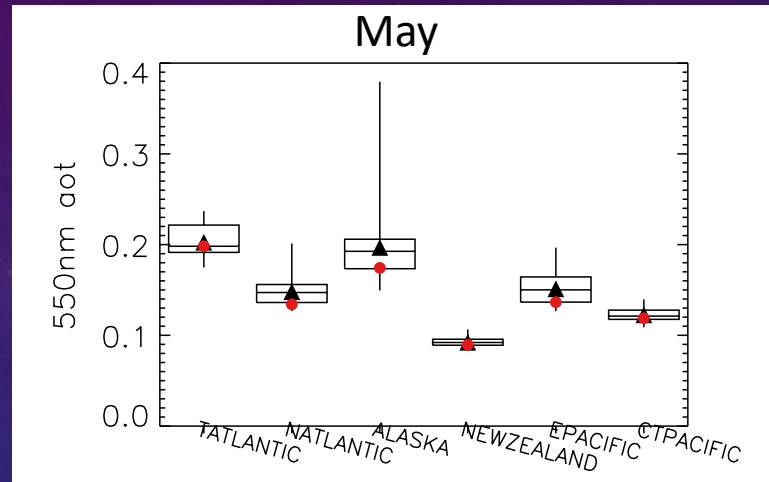
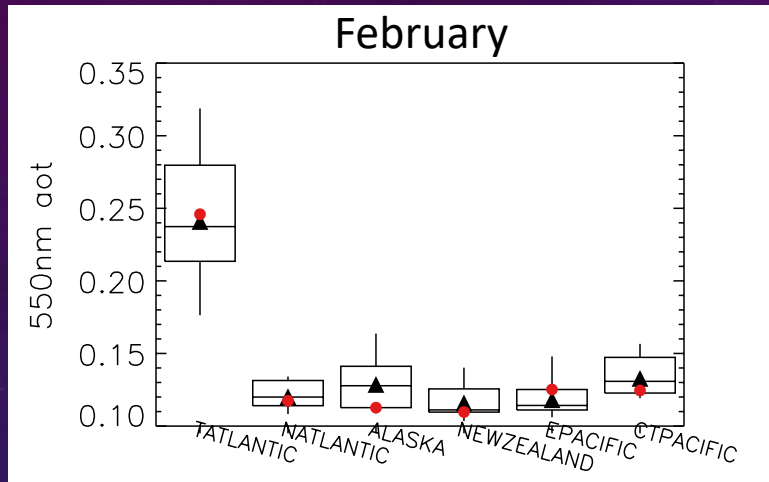
Feb., de-trended timeseries



2018 more
average with
trend
removed

Removing
trend shrinks
inter-quartile
range

IAV IN MODIS AEROSOL OPTICAL THICKNESS



AOT on the low side for most regions in May and Aug. (Atom-4 & -1), high side in Oct.(ATom-3)

SIGNIFICANT CORRELATIONS WITH BIOMASS BURNING EMISSIONS

MOPITT column
MOPITT 700 hPa
MLS 215 hPa

Correlation between regional CO & BB from other regions

Region for CO:	Tropical Atlantic	North Atlantic	Alaska	New Zealand	East Pacific	Cen. Trop. Pacific
Feb. (A2)	NH Africa NH Africa NH Africa	NH Africa		NH Africa Amazon	NH Africa NH Africa NH Africa Amazon ENSO (MEI)	NH Africa Amazon
May (A4)		Siberia SH Africa SH Africa SH Africa	Siberia Siberia SH Africa SH Africa	Driven by negative trend, correlation insignificant if trend removed		
Aug. (A1)	NH Africa SH Africa	Siberia	Siberia	SH Africa SH Africa Indonesia	Amazon	
Oct. (A3)	Siberia Amazon	Siberia Siberia Siberia	Siberia Siberia	Amazon Amazon	Amazon	Siberia NH Africa

SUMMARY

- MOPITT, MLS, and MODIS show IAV in CO and aerosols over regions sampled during ATom
- CO during ATom was below average for most regions and seasons
- AOT above average during ATom-3 & over the Tropical Atlantic, mostly below average for other deployments/regions
- CO variability correlates with Siberian, African and S. American biomass burning for several regions and seasons